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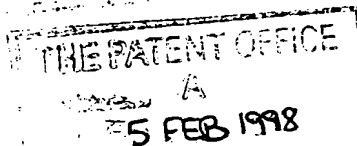
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Your reference

801-49GB

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# Request for grant of a Patent

Form 1/77

Patents Act 1977

**1 Title of invention**

1 Please give the title of the invention MINIMUM TILL SEEDING KNIFE

**2 Applicant's details****2a First or only applicant**

2a If you are applying as a corporate body please give:

Corporate name Flexi-Coil Ltd.

Country (and State of incorporation, if appropriate) Canada

2b If you are applying as an individual or one of a partnership please give in full:

Surname

Forenames

2c In all cases, please give the following details:

Address 1000 - 71st Street East  
Saskatoon, Saskatchewan  
Canada S7K 6E2

UK postcode (if applicable)

Country

ADP number (if known)

451401002

2d and 2f: If there are further applications please provide details on a separate sheet of paper.

☐ **Second applicant (if any)**

2d If you are applying as a corporate body please give:

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Ⓢ An address for service in the United Kingdom must be supplied

Please mark correct box

Ⓢ **Address for service details**

3a Have you appointed an agent to deal with your application?

Yes ☒ No ☐ → go to 3b

↓  
please give details below

Agent's name Anthony ASQUITH

Agent's address 328 Leeds Road, Scholes  
LEEDS LS15 4DD  
England

Postcode

Agent's ADP  
number

2657096003

3b: If you have appointed an agent, all correspondence concerning your application will be sent to the agent's United Kingdom address.

3b If you have not appointed an agent please give a name and address in the United Kingdom to which all correspondence will be sent:

Name

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① Reference number

4 Agent's or  
applicant's reference number (if applicable) 801-49GB

### ⑥ Claiming an earlier application date

5 Are you claiming that this application be treated as having been filed on the date of filing of an earlier application?

Yes ☐ No ☒  $\Rightarrow$  go to 6

↓  
please give details below

☐ number of earlier application or patent number

filing date

day	month	year
-----	-------	------

☐ and the Section of the Patents Act 1977 under which you are claiming:

15(4) (Divisional) ☐ 8(3) ☐ 12(6) ☐ 37(4) ☐

### ④ Declaration of priority

**6 If you are declaring priority from previous application(s), please give:**

Country of filing

Priority application number  
(if known)

**Filing date**  
(day, month, year)

**⑥ If you are declaring priority from a PCT Application please enter 'PCT' as the country and enter the country code (for example, GB) as part of the application number.**

**Please give the date in all number format, for example, 31/05/90 for 31 May 1990.**

⑦ The answer must be 'No' if:

- a. applicant is not an inventor
- the applicant is not an inventor who is not an applicant, or
- an applicant is a corporate body.

⑧ Please supply duplicates of claim(s), abstract, description and drawing(s).

Please mark correct box(es)

⑨ You or your appointed agent (see Rule 90 of the Patents Rules 1990) must sign this request.

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A completed fee sheet should preferably accompany the fee.

## ⑥ Inventorship

7 Are you (the applicant or applicants) the sole inventor or the joint inventors?

Please mark correct box

Yes ☐

No ☒

A Statement of Inventorship on Patents Form 7/77 will need to be filed (see Rule 15).

## ⑦ Checklist

8a Please fill in the number of sheets for each of the following types of document contained in this application.

Continuation sheets for this Patents Form 1/77

Claim(s)

10

Description

14

Abstract

1

Drawing(s)

4

8b Which of the following documents also accompanies the application?

Priority documents (please state how many)

Translation(s) of Priority documents (please state how many)

Patents Form 7/77 - Statement of Inventorship and Right to Grant (please state how many)

Patents Form 9/77 - Preliminary Examination/Search

Patents Form 10/77 - Request for Substantive Examination

## ⑧ Request

We request the grant of a patent on the basis of this application.

Signed

Anthony Asquith

Date 05 February 1998  
(day month year)

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## MINIMUM TILL SEEDING KNIFE

### FIELD OF THE INVENTION

The present invention relates to a method of farming, a farm implement and  
5 a knife or knife assembly which may be used as part of no-till or minimum-  
till farming practices primarily for placement in the ground of seed and/or  
fertilizer and other materials. The invention works well in all field  
conditions, and in particular it operates with minimum soil disturbance in  
10 minimum till and zero till farming practices, better allows passage of trash in  
such practices, and does not cause the hair-pinning of crop residue as is  
often caused by disc-type openers. As a result, the method provides a  
simple, reliable and inexpensive procedure and tool which can be used in  
all farming practices so that multiple types of equipment are not required by  
farms for various soil conditions.

15

### BACKGROUND OF THE INVENTION

Important advantages have been found in soil preparation, and seed and  
fertilizer delivery in employing no-tilling or minimum tilling methods which  
cause minimum disturbance to the soil. This is particularly important in dry  
20 land conditions where the soil is subject to moisture and topsoil loss if  
conventional tilling methods are used.

It is usually desirable when employing no-till farming practices to disturb  
the soil surface as little as possible. The surface will be covered with the  
residue from previous crops, and the surface layer will contain old root  
25 structure. This plant material can serve to retain moisture below the surface  
and to assist in securing the soil against runoff and erosion. Particularly in

It is known to prepare soil when using traditional tilling methods to cut out weed growth prior to or at the time of a seeding operation.

US patent No. 1,085,825 issued in 1914 to Rubarth discloses a subsurface tilling blade for use with a traditional turning plowshare. The tilling blade is curved to angle the cut and includes a horizontal blade on the opposite side. The blades are shown to include an arrangement in overlapping fashion to cut the full width of the subsurface to remove weeds and old growth. Seeding and fertilizing are separate operations.

US patent No. 5,005,497 issued in 1991 to Kolskog discloses a deep banding knife for delivering seed and fertilizer with an additional transverse rod for disrupting weed growth. The banding knife makes a substantially vertical cut in the soil. The rod disrupts the subsoil to loosen soil and cut weeds. The transverse rods can be arranged in parallel to remove weeds completely.

Adaptations of these concepts have been used for deep placement of fertilizer in fully tilled row-crop situations.

In traditional zero till farming practice, no till furrows are separated by undisturbed areas of soil and weeds. Typically a herbicide application is necessary to control weeds which would otherwise compete with the crop growth and possibly contaminate the harvest. Herbicide is an expensive additional operation.

A further problem encountered by seeding implements particularly in zero till conditions is the accumulation of trash during seeding which impairs their operation. Many devices for seeding in zero till conditions provide a blade which penetrates the soil substantially vertically. Trash gathers around the blade and is dragged with the device. This can impair operation. It also

hairpinning. It is desired to provide the advantages of tilling, seeding and weed clearing without trash accumulation.

## SUMMARY OF THE INVENTION

- 5 The invention provides a ground opening knife for use in no-till or minimum-till farming operations primarily in conjunction with seed and/or fertilizer placement adjacent a soil cut-line generally in the direction of travel comprising connection means adapted to mount the knife on a farm implement, and a blade comprising a lower portion, said lower portion  
10 adapted to open the soil along the direction of travel, said lower portion adapted to extend into the soil but no more than 6 inches measured vertically, said lower portion adapted to be oriented in a direction having a 1<sup>st</sup> component of between 30 and 60 degrees below horizontal in a plane transverse to the said direction of travel, and a 2<sup>nd</sup> component forward in the  
15 direction of travel.

The knife may include an upper portion adjacent said lower portion adapted to extend away from the surface of the soil and is adapted to pass through materials or residue on the surface of the soil or associated with the passage of the knife through the soil.

- 20 The knife may also include an extension extending substantially laterally from said lower portion and provides support for material delivery tubes at various locations along the blade and extension.

The knife may also include in extension to form a secondary furrow adjacent the said lower portion intermediate the surface of the soil and the lowermost



between 30 and 60 degrees below horizontal in a plane transverse to the said direction of travel, and a 2<sup>nd</sup> substantial component forward in the direction of travel.

The farm implement may include an extension of the blade extending laterally across a substantial portion of said spacing between adjacent said cut-lines when viewed in plan view.

The invention will be more clearly understood to those skilled in the art with the following detailed description of preferred embodiments with reference to the following drawings in which:

10

#### BRIEF DESCRIPTION OF THE FIGURES

Figure 1 is a plan view of a single knife according to the present invention;

Figure 2 is a side view of the embodiment of Figure 1;

Figure 3 is a front view of the embodiment of Figure 1;

15 Figure 4 is a plan view of a further embodiment according to the present invention;

Figure 5 is a side view of the embodiment of Figure 4;

Figure 6 is a front view of the embodiment of Figure 4;

20 Figure 7 is an isometric view of the embodiment of Figure 4 arranged on an implement for operation; and

Figures 8-1 through 8-3 are front, top and side elevations respectively of another embodiment of the invention adapted for double shooting of materials in seeding.

respectively is 45 degrees. Soil penetration is by the lower portion of the blade as at 6 in Figure 3 and is no more than 6 inches, consistent with minimum till or no till farming practises.

5 The lateral component A1 of angle A determines the final angle of the furrow cut into the soil. The angled furrow allows seed to be planted ensuring soil cover.

10 The blade is also angled significantly forwardly by component A2 of angle A. Preferably lower end 17 of the cutting edge 16 is significantly in advance of the upper end 15 of the cutting edge 16. Deeper soil is cut and lifted in advance of cutting the surface soil allowing the surface to be cut along cut-line 11 more easily and without undue lateral disruption. Vertical motion is limited. The forward component of angle A of the blade cuts through the surface and trash layers last without accumulating trash on the knife 10. Leading edge 16 is preferably continuous from its lower end 17 to its upper end 15.

20 The blade 14 has a leading cutting edge 16 and a pair of opposing angled surfaces 18a and 18b which form a wedge shaped profile. The profile shape is determined by the furrow opening required. Edge 16 may be in 2 parts, 1 below the surface and another above but preferably extends continuously above the surface sufficient to move trash and other materials aside without accumulation. Also preferably it is formed aligned with the leading edge of the lower portion of the blade.

25 Preferably surface 18b is inclined slightly from the horizontal to avoid sliding contact with the soil below the blade 14 and minimize soil disturbance below the cut.

at the lowest end of the blade for deepest application and a seed outlet spaced above it on the angled blade 14.

Another preferred embodiment is shown in Figures 8 in which Figure 8-1 shows the embodiment in a front view, Figure 8-2 in a plan view and Figure 8-3 is a side elevation.

In Figures 8 the embodiment is shown in conjunction with the knife and method shown in Figures 1-3 with a additional double shoot extension 8. Leading edge 16 of the lower portion 7 is extended further forward and downward as best depicted in Figure 8-3. As seen in the front view of Figure 8-1 this will provide a secondary furrow or ledge intermediate the surface of the soil 5 and the lower end 17. Figures 8 show this embodiment as forming a v-shaped furrow particularly suited to the deposit of particulate material such as seed which would be retained in this groove. The extension 8 could have other shapes to form a ledge or other shape as required.

As extension 8 depends from lower surface 18b, extension 6 may be provided with a delivery conduit 19.

This double shoot method forms a seed or other material positioning shelf or secondary furrow within the angled furrow with a specific spacing from the lowermost extremity.

An alternate embodiment of the invention is shown in Figures 4-6. The knife 10 includes a blade 14 as described above. The knife 10 further includes an extension blade 30 that extends substantially horizontally from the blade 14 preferably at its lowermost end 17. The extension blade 30 has a leading cutting edge 36, which preferably forms a continuation of or 3<sup>rd</sup>

this case the complete width of soil could be planted. Roots in the complete width of soil may also be cut by the blade extension without being dragged and fouling the knife 10.

The extension blade 30 may be positioned to travel under the path of the angled blade 14 of the adjacent knife 10.

Knives 10 are mounted to an implement or cultivator frame as in Figure 7. A wing section of the frame is illustrated in outline form. Additional central and wing sections are not shown. The frame is carried on load bearing wheels (not shown) which support the frame in a raised position for travel and in operative position.

Adjustment of the height of the frame in a known fashion accurately controls furrow depth. Depths may typically range from  $\frac{1}{2}$  inch to 4 inches or up to 6 inches. Alternatively, a ground following linkage may be used to attach each knife to the frame, with the depth being controlled by a wheel attached to each knife assembly.

In use the knives 10 arranged in parallel fashion on an implement or overlapping arrangement on an angled draw bar are drawn by a tractor together with a seed carrier provided with reservoirs of seed and fertilizer material and a fluid delivery system operatively connected with the conduits 22 on the knives 10. The frame 2 is advanced with the leading cutting edges 16 and, optionally, 36 facing in the direction of travel 1. The deposit of material is controlled to the speed of advance at the tractor in a known fashion.

The knife 10 will not normally produce overlapping furrows without the blade extension 30 being present, or being long enough to result in an

## WHAT WE CLAIM IS:

- 1) A ground opening knife for use in no-till or minimum-till farming operations primarily in conjunction with seed and/or fertilizer placement adjacent a soil cut-line generally in the direction of travel comprising:
  - 5 i) Connection means adapted to mount the knife on a farm implement, and
  - ii) A blade comprising:
    - (1) A lower portion,
    - (2) Said lower portion adapted to open the soil along the direction  
10 of travel,
    - (3) Said lower portion adapted to extend into the soil but no more than 6 inches measured vertically,
    - (4) Said lower portion adapted to be oriented in a direction having:
      - 15 (a) A 1<sup>st</sup> component of between 30 and 60 degrees below horizontal in a plane transverse to the said direction of travel, and
      - (b) A 2<sup>nd</sup> component forward in the direction of travel.
- 2) A ground opening knife as claimed in claim 1 wherein the said lower portion is adapted so as to substantially minimize any disturbance of the  
20 soil above the said lower portion.
- 3) A ground opening knife as claimed in claim 2 wherein the said lower portion is further adapted so as to substantially minimize any disturbance of the soil below the said lower portion.

- 14) A ground opening knife as claimed in claim 13 wherein said cutting edge is formed adjacent the lower surface of said blade.
- 15) A ground opening knife as claimed in claim 14 wherein said cutting edge includes a blade surface extending at about 45 degrees from said cutting edge.
- 16) A ground opening knife as claimed in claim 15 wherein said cutting edge includes a 2<sup>nd</sup> blade surface aligned generally in the direction of travel.
- 17) A ground opening knife as claimed in claim 16 wherein said 2<sup>nd</sup> blade surface is inclined slightly upward.
- 18) A ground opening knife as claimed in claim 1 wherein said blade further comprises at least one delivery conduit for placing material in the furrow cut by the blade.
- 19) A ground opening knife as claimed in claim 18 wherein said blade further comprises means to form a secondary furrow adjacent the said lower portion intermediate the surface of the soil and the lowermost end of the said blade.
- 20) A ground opening knife as claimed in claim 19 wherein said secondary furrow means includes an extension of the surface of said blade.
- 21) A ground opening knife as claimed in claim 20 wherein said secondary furrow means extension is primarily of the lower surface of said blade.

31) A ground opening knife as claimed in claim 30 wherein said cutting edge is formed adjacent the lower surface of said blade.

32) A ground opening knife as claimed in claim 31 wherein said cutting edge includes a blade surface extending at about 45 degrees from said cutting edge.

33) A ground opening knife as claimed in claim 32 wherein said cutting edge includes a 2<sup>nd</sup> blade surface aligned generally in the direction of travel.

34) A ground opening knife as claimed in claim 33 wherein said 2<sup>nd</sup> blade surface is inclined slightly upward or inward.

35) As in claim 1 wherein said blade further comprises an extension extending substantially laterally from said lower portion.

36) As in claim 35 wherein said extension extends from the lowermost part of said blade.

37) As in claim 36 wherein said extension is substantially horizontal and transverse to the direction of travel.

38) As in claim 37 wherein said extension extends outward from said lower portion.

39) A ground opening knife as claimed in claim 38 wherein the said lower portion is adapted so as to substantially minimize any disturbance of the soil above or below the said lower portion.

40) A ground opening knife as claimed in claim 39 wherein the said blade includes an upper portion adjacent said lower portion adapted to extend away from the surface of the soil and is adapted to pass through materials

50) A ground opening knife as claimed in claim 49 wherein said conduit includes at least one outlet for said materials to the rear of said extension.

51) A method of no-till or minimum-till farming operation primarily in conjunction with seed and/or fertilizer placement adjacent a soil cut-line aligned generally in the direction of travel comprising:

i) Forming a furrow in the soil extending from said soil cut-line no more than 6" into the soil measured vertically, and

ii) Forming the said furrow by cutting the soil along a direction having:

(a) A 1<sup>st</sup> component of between 30 and 60 degrees below horizontal in a plane transverse to the said direction of travel, and

(b) A 2<sup>nd</sup> component forward in the direction of travel.

52) A method as claimed in claim 51 further comprising forming said furrow so as to substantially minimize any disturbance of the cut soil either above the said furrow or below it or both.

53) A method as claimed in claims 51 or 52 further comprising forming said furrow so as to pass through substantially any materials or residue on the surface of the soil or associated with the formation of said furrow.

54) A method as claimed in claim 53 wherein said 2<sup>nd</sup> component is substantial.

55) A method as claimed in claim 54 wherein said 2<sup>nd</sup> component is 30 to 60 degrees.



65) A method as claimed in claim 64 further wherein said delivery is immediately following formation of said horizontal extension.

66) As in claim 65 wherein said delivery is in distinct rows aligned in the direction of travel.

5 67) As in claim 66 wherein delivery is scattered in the horizontal extension of said furrow.

68) A no-till or minimum-till farm implement primarily for use in conjunction with cultivation or materials placement adjacent a plurality of soil cut-lines generally parallel and in the direction of travel  
10 comprising:

a) A support frame structure,

b) A plurality of ground opening knives attached to said support structure, spaced from each other in a direction transverse to the direction of travel of the implement and each adapted to cut the soil  
15 along adjacent ones of said cut-lines,

c) Each said knife having a blade comprising:

i) A lower portion,

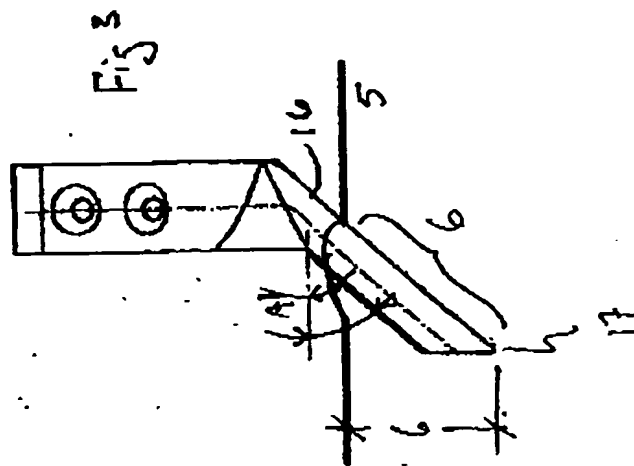
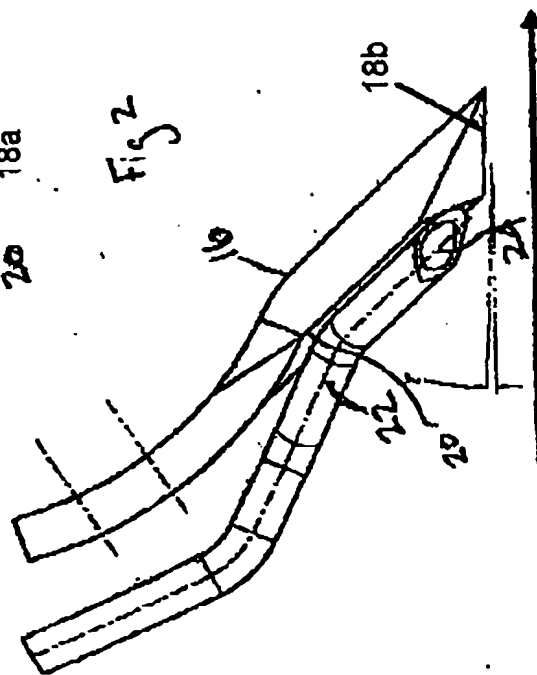
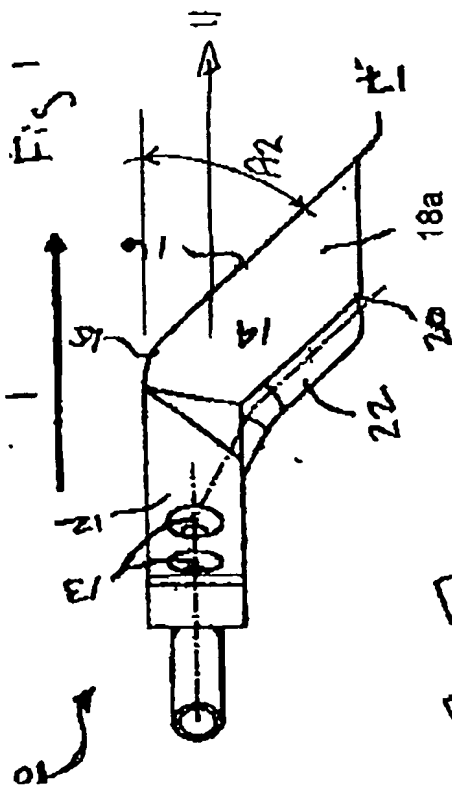
ii) Said lower portion adapted to open the soil along the direction of travel,

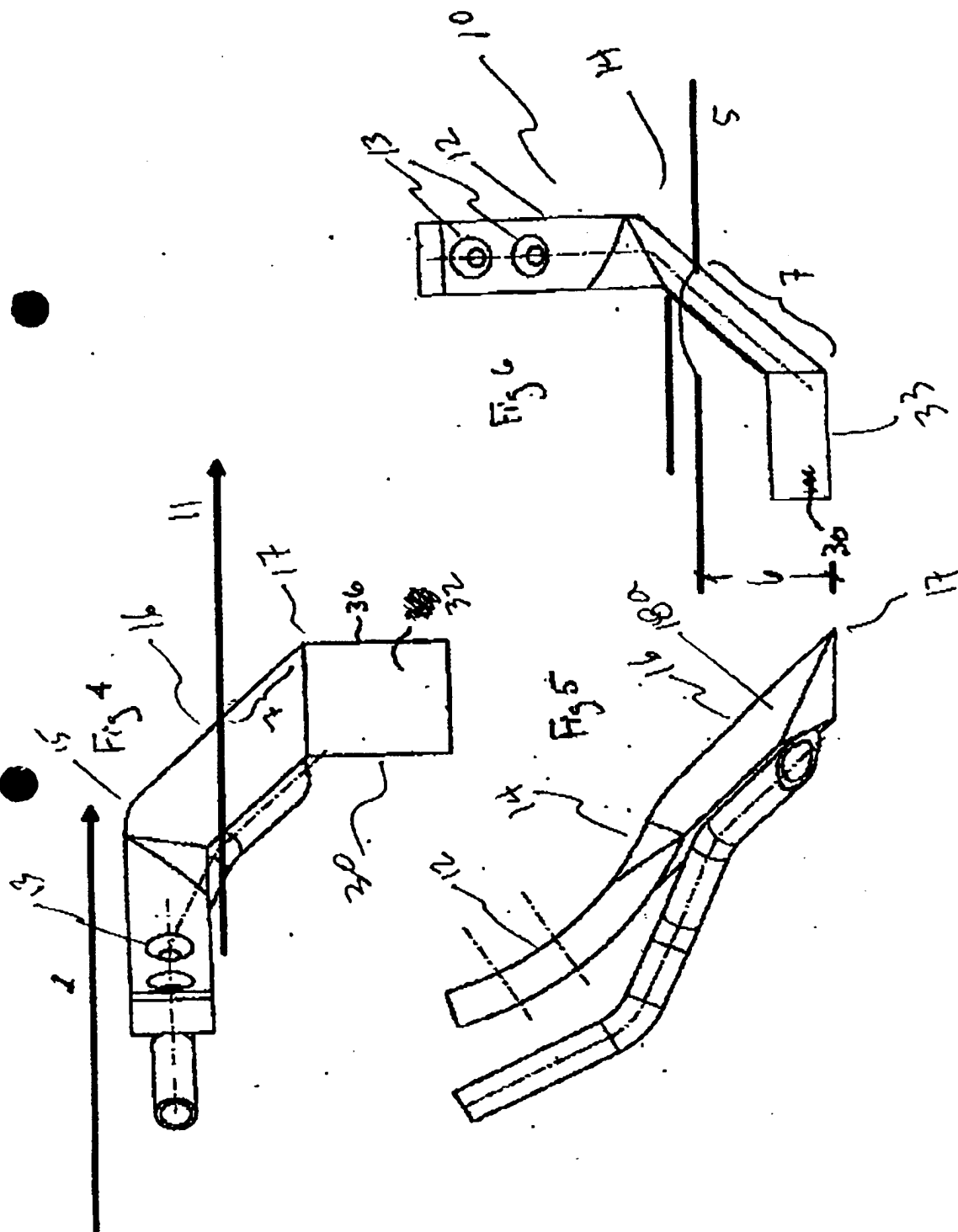
20 iii) Said lower portion adapted to extend into the soil but no more than 6 inches measured vertically between the surface of the soil and the lowermost extremity of said blade,

iv) Said lower portion adapted to be oriented in a direction having:

## ABSTRACT OF THE DISCLOSURE

The present invention relates to a knife for and a method of zero till or minimum till seeding and fertilizing. The knife is particularly adapted for dry land conditions producing minimum soil disturbance and very shallow operation. The knife has a high penetration angle preferably of 45 degrees which permits the blade to enter high trash surface cover with little tendency to plug due to trash accumulation. The blade has a forward angle of attack, the lower cutting edge advancing before the upper cutting edge, serving to make a clean cut in the soil surface without accumulating trash. Seed and/or fertilizer conduits are attached to or incorporated in the trailing face of the blade on which the outlets may be spaced for controlled placement of the materials. By the method a furrow is cut having a substantial transverse component in an operation with a substantial forward component. A preferred embodiment includes a horizontal extension blade for cutting a horizontal swath at a shallow depth through weed growth. Conduits may be secured to the extension to allow greater separation and control of material placement. The knives may be arranged in overlapping configuration on the draw bar to effect weed cutting, seeding and fertilizing of a complete width of soil in a single pass.





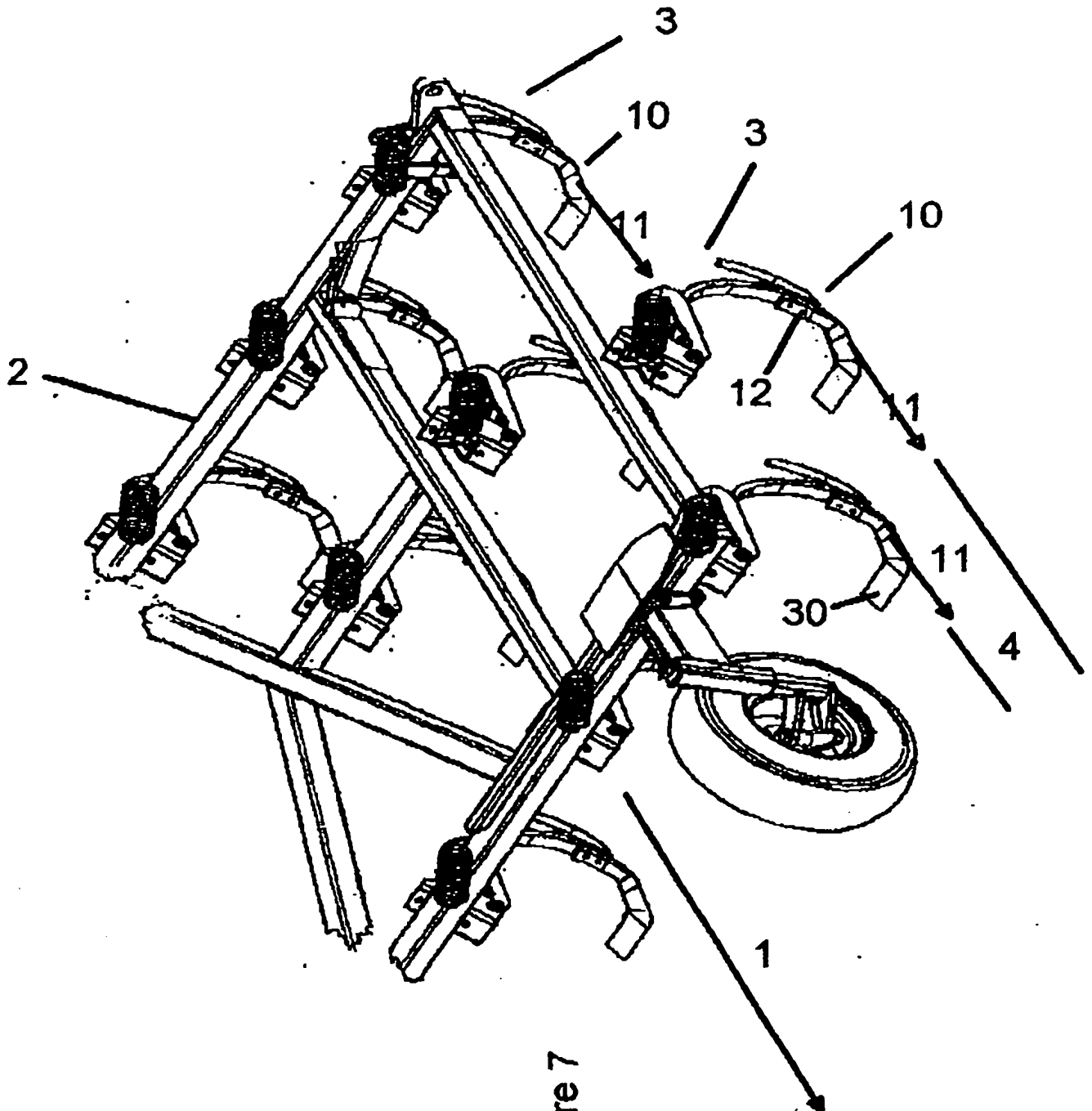


Figure 7

Figure 8-2

Figure 8-1

Figure 8-3

